Journal of Endodontics, 1997 Vol. 23

MARCH

59th Medical Wing, 59th Dental Squadron, Endodontics Flight:

Endodontics Chairman:
Steven R. Hansen, Col., USAF, DC 47E3

List of Articles

Click on the article you wish to view

Tepel J, Schäfer E, Hoppe W. Properties of endodontic hand instruments used in rotary motion. Part 3. Resistance to bending and fracture. J Endodon 1997;23:141-5.

PURPOSE: To evaluate the bending and the resistance to fracture of nickel-titanium K-files, titanium-aluminium K-files and reamers, stainless steel K-files and reamers, and flexible stainless steel instruments according to ISO 3630-1.

M&M: Resistance to bending and resistance to fracture were determined with a testing apparatus corresponding to ISO 3630-1. The following root canal instruments were tested: (a) nickel-titanium K-files (made by two manufacturers), (b) titanium-aluminium K-files and reamers (Microtitane instruments made by one manufacturer), (c) conventional stainless steel instruments (K-files and reamers made by 7 manufacturers), (d) flexible stainless steel instruments (5 instruments made by 4 manufacturers). Instrument sizes #15, 25 and 35 were tested, with ten instruments for each type and size.

RESULTS: None of the instruments exceeded the maximum bending moments given in ISO 3630-1. In ascending order of bending moment the instruments ranked: nickel-titanium K-files, titanium-aluminium K-files and reamers, flexible stainless steel instruments, conventional stainless steel K-files and reamers. Nickel-titanium, titanium-aluminium, and flexible stainless steel instruments displayed lower torque values than conventional stainless steel K-files and reamers. Conventional stainless steel K-files and reamers showed about the same torque. In most cases, K-files reached greater angular deflection than reamers of the same brand.

C&C: None of the instruments tested fractured after a 180^0 rotation. Except for nickel-titanium instruments, visible nonelastic deformation occurred before fracture, which lead to an obvious unwinding of the twisted instruments.

March 1997 **Orest M. Harkacz, Sr.**

Yared GM, Dagher FB, Machtou P. Influence of the removal of coronal gutta-percha on the seal of root canal obturations. J Endodon 1997;23:146-8.

PURPOSE: To use the fluid filtration technique to compare the quality of the coronal seal of cold lateral and warm vertical condensation in coronal unsealed root canals.

M&M: 100 teeth were decoronated to uniform root length, and prepared to a size 30 apically. WL was .5 mm short of the apical foramen. Flaring was accomplished, and heat carriers were adjusted so that they penetrated no more than to the apical 10 mm of GP. Teeth were obturated using GP and Kerrs Pulp Canal Sealer. Groups 1 and 2 had vertical and lateral condensation respectively, with GP removed by heat only. Groups 3 and 4 had vertical condensation respectively, and GP removed by heat alternated with compaction of the heat softened GP. After 30 min, teeth were tested in the Pashley device at 1.5h, 1 d, and 1, 4, 12, 18, and 24 wk after obturation.

RESULTS: Groups 2 and 4 showed significantly more leakage at 24 wk than at 18 wk. Coronal leakage did not significantly increase in groups 1 and 3 over the same period.

C&C: There was a trend toward increased leakage with time in all groups, which is disturbing. Anytime heat is used in the canal, either during obturation or removal of GP, it behooves us to vertically compact the softened mass to help counter the expected shrinkage of the warm GP.

March 1997 **Robin E. Hinrichs**

Reeh ES, Combe EC. A new single-step technique for apical retrofilling that significantly reduces microleakage. J Endodon 1997;23:149-51.

PURPOSE: To ascertain the suitability of polyacrylic acid (PAA) as a dentin bonding agent for use in apical retrofillings and to establish if bonding could reduce the microleakage of retrofillings.

M&M: 60 single-canaled roots were divided into 6 groups of ten. After mounting the teeth in acrylic resin with the roots exposed, 2 to 3 mm of the apical ends of the roots were sectioned off perpendicular to the long axis of the root. Retropreparations were cut in each root to a depth of 2 to 3 mm with ultrasonics. The six groups were retrofilled in random order with the following materials being used: EBA (Group I), amalgam (Group II), Durelon (Group III), Durelon with the application of extra PAA to condition the dentin (Group IV), Glass-ionomer (Group V), and EBA/PAA (Group VI). Leakage was evaluated by coating the teeth with nail varnish, immersing them in methylene blue dye for 72 hours, then sectioning them along their long axis and measuring the leakage with 20x magnification.

RESULTS: The experimental data for Groups I, II, III, and IV were not continuous, i.e. the dye had penetrated beyond the floor of the retropreparation in one or more samples. The data for Groups V and VI were continuous. The mean depths of dye penetration for these groups were: Group V, 1.48 ± 0.58 mm, and Group VI, 1.32 ± 0.48 mm, which were not significantly different.

C&C: The impression given was that the cements were evaluated immediately after root-end filling (no delay to allow set of material). Leakage of EBA appeared to have been reduced when the dentin was pretreated with an aqueous solution of PAA. Application of PAA to Durelon did not improve the seal of the material. Seal with glass ionomer and EBA/PAA were similar. No long term immersion was accomplished. Preps should have been standardized to either 2 or 3 mm, not 2 to 3 mm (variability of 1 mm can throw off readings and influence leakage).

March 1997 **Orest M. Harkacz, Sr.**

Todd WM, Kafrawy AH, Newton CW, Brown CE. Immunohistochemical study of gamma-aminobutyric acid and bombesin/gastrin releasing peptide in human dental pulp. J Endodon 1997;23:152;7.

PURPOSE: To investigate the presence of the putative peripheral neuromodulators GABA and BN/GRP in the human tooth pulp.

M&M: 31 teeth, 15 normal and 15 carious were used. Criteria included evidence of carious involvement, lack of symptoms on day of surgery, and absence of evidence, both clinical or radiographic of periapical pathosis. Teeth had their apical half of the root removed upon extraction to facilitate fixation. Sections were decalcified and were stained for GABA and BN/GRP.

RESULTS: Pulpal staining for GABA-L1 was 0.92 for the normal, and 1.84 for the carious teeth. Dentinal staining for GABA-L1 showed means of 0.38 and 0.99 for normal and carious teeth respectively. Pulpal staining for BN/GRP-L1 was 0.77 and 1.42 for normal and carious teeth respectively. Dentinal staining for BN/GRP-L1 was virtually nil for normal teeth, and light for the carious group, 0.02 and 0.61 respectively. There was significant correlation between caries penetration and pulpal inflammation, and between GABA-L1 levels and the degree of pulpal inflammation.

C&C: GABA is the main inhibitory neurotransmitter w/in the CNS. Receptors have also been found on A-delta and C-fiber afferent axons. The theory of GABA as a peripheral neuromodulator may help explain the observation that pain is an infrequent or late sequelae to caries or pulpal pathosis. Possibly the bacteria are producing the GABA, keeping symptoms down and aiding its progression.

March 1997 **Robin E. Hinrichs**

Snyder WR, Hoover J, KhourymR, Farach-Carson MC. Effect of agents used in perforation repair on osteoblastic cells. J Endodon 1997;23:158-61.

PURPOSE: To examine the osteoblastic responses to several different dental materials.

M&M: The bone-forming activity of osteoblasts was assessed by measuring the steady-state mRNA levels encoding for two noncollagenous bone matrix proteins, osteopontin (OPN) and osteocalcin (OCN). Materials evaluated included: GC Dentin Cement, Super-EBA, Roth Root Canal Cement, Amalgam Valiant Ph.D., Ketac Endo, IRM, Cavit-G and Ketac Bond. Mixed samples were stored in sterile water for 10 days to extract water-soluble components. The extracts were added to a medium of osteoblastic ROS 17/2.8 cells and cultured for 48 hours. The negative control consisted of vehicle-treated culture in which 100 μl of sterile water treated in parallel with the study samples was added to the cells. In the positive control, 1,25-dihydroxyvitamin D_3 was added to the cells at the start of the incubation period. After 48 hours, total RNA was extracted and analyzed with specific radiolabeled cDNA probes using Northern blotting to measure mRNA levels of OPN and OCN. mRNA levels in treated samples were compared with controls. Blots were exposed to autoradiographic film for varying periods of time ranging 1-14 days, and band intensity corresponding to mRNA levels encoding OPN and OCN on developed films was quantitated using a densitometer.

RESULTS: No material tested was grossly cytotoxic to the osteoblastic cells by visual assessment, including disruption of focal adhesions, cell morphology, or cell number. All exposed films of mRNA extracts from cells treated with 1,25-dihydroxyvitamin D_3 showed OPN and OCN mRNA levels significantly higher than any of the samples or controls. For OCN, the mean levels of mRNA after treatment with Ketac Endo, IRM, Cavit-G, and Ketac Bond were higher than the mRNA levels of the vehicle control. Cavit-G consistently produced nearly a 2-fold stimulation of mRNA accumulation for OCN in both experiments. The Valiant Ph.D. samples expressed levels of mRNA-encoding OCN that were significantly lower than that of the vehicle control. All of the differences noted were small in magnitude compared to the positive stimulator, 1,25-dihydroxyvitamin D_3, which produced a 6-fold induction of mRNA level. For OPN, the mean levels of mRNA after treatment with Ketac Endo, IRM, and Cavit-G were substantially higher than the mRNA levels of the vehicle-treated control. There were no samples that showed significantly lower levels of expressed OPN mRNA than the vehicle control, although several demonstrated little if any effect on OPN biosynthesis. Ketac Endo produced a significant (2-fold) stimulation of OPN mRNA levels in both experiments.

C&C: The bottom line is that the materials used in perforation repair currently may produce small, measurable effects on osteoblastic responses. Valiant Ph.D. may have a negative effect on osteoblastic response.

March 1997 **Orest M. Harkacz, Sr.**

Yoshikawa MY, Hayami S, Tsuji I, Toda T. Histopathological study of a newly developed root canal sealer containing tetracalcium-dicalcium phosphates and 1.0% chondroitin sulfate. J Endodon 1997;23:162;6.

PURPOSE: To compare the biocompatibility and healing ability of newly developed sealers and to estimate the participation of these sealers in the periapical wound healing.

M&M: 2 new sealers, TDM and TDM-S were compared to a known sealer Apatite Root Sealer (ARS). TDM and TDM-S both contain dibasic calcium phosphates and tetracalcium phosphate. The TDM-S also contains chondroitin sulfate. All three material were placed subcutaneously in rat backs, and in prepared rat 1st molar canals. Observation periods were from 1 - 4 wks.

RESULTS: There were no inflammatory reactions in the tissue to TDM implants at any time periods. Infiltrated collagenous tissue and capillaries were observed at 3 and 4 wks. The TDM-S implants showed no acute inflammation, but multinucleated giant cells and macrophages were observed around the implants. A large area of necrosis was observed around the ARS implant. Periapical reaction was similar. The TDM treated canals showed no inflammation, and occasional cementum-like deposition was seen apically. The TDM-S had a small number of PMNs periapically, with macrophages and giant cells present early. Osteoblasts were observed, but no hard tissue deposition was seen. There was encapsulation of the apical foramen with a layer of fibrous connective tissue. The ARS showed severe acute inflammatory reactions, with resorption of periapical alveolar bone in some specimens.

C&C: The addition of chondroitin-sulfate did not enhance the non-toxic response of the sealer. The dicalcium phosphate dihydrate converts to hydroxy apatite and has the ability of self-setting in a short time at room temperature. This material shows some promise, but many more factors need to be studied. A sealer that promotes bony repair would be highly sought after.

March 1997 **Robin E. Hinrichs**

Siqueira JF, de Uzeda M. Intracanal medicaments: evaluation of the antibacterial effects of chlorhexidine, metronidazole, and calcium hydroxide associated with three vehicles. J Endodon 1997;23:167-9.

PURPOSE: To compare the antibacterial activity of chlorhexidine, metronidazole, and calcium hydroxide mixed with different vehicles against bacterial species commonly isolated from infected root canals.

M&M: Antibacterial activities of the medicaments were evaluated against obligate and facultative anaerobic bacteria. Medicaments included: (a) calcium hydroxide powder mixed with distilled water, (b) calcium hydroxide powder mixed with CPMC, (c) calcium hydroxide powder mixed with glycerin, (d) chlorhexidine digluconate 0.12% gel, and (e) metronidazole 10% gel. The obligate anaerobes consisted of: *Porphyromonas endodontalis, Porphyromonas gingivalis, Actinomyces israelii, Fusobacterium nucleatum, Propionibacterium acnes,* and *Campylobacter rectus.* The facultative anaerobes used were: *Staphylococcus aureus, Streptococcus mutans, Streptococcus sanguis, Streptococcus salivarius, Enterococcus faecalis,* and *Actinomyces viscosus.* The agar diffusion test was used where wells of 5 mm depth and 6 mm diameter were punched in agar plates and filled with the medicaments to be tested. Metronidazole was tested against the obligate anaerobic bacteria only. Positive control plates were streaked with bacteria, but no medicament was used. Zones of inhibition were measured after 7 days.

RESULTS: Calcium hydroxide mixed with CPMC showed large zones of inhibition against all bacterial strains tested. Chlorhexidine 0.12% was also inhibitory against all strains, but on the whole it was not more effective than calcium hydroxide with CPMC. Metronidazole was effective against all obligate anaerobes tested (it was more effective that calcium hydroxide and CPMC only against *P. endodontalis* and *F. nucleatum).* Calcium hydroxide mixed with distilled water or glycerin was ineffective against all bacterial strains used in this experiment.

C&C: They should have included a group evaluating only CPMC to determine if it alone is the effective medicament, or if it is the mixture of calcium hydroxide with this material which makes it so effective. Calcium hydroxide plus CPMC yields calcium paramonochlorophenolate, which is a weak salt that progressively releases paramonochlorophenol (PMC) and hydroxyl ions to the surrounding medium. Released PMC may be responsible for the zones of inhibition seen in the study.

March 1997 **Orest M. Harkacz, Sr.**

Tucker DM, Wenckus CS, Bentkover SK. Canal wall planning by engine-driven nickel-titanium instruments, compared with stainless steel hand instrumentation. J Endodon 1997;23:170-3.

PURPOSE: To quantify canal wall planing achieved by hand instrumentation using stainless-steel files, compare with engine-driven nickel-titanium files in curved canals.

M&M: 30 mesial roots were used, the ML canal being the experimental canal, and the MB canal the control. Half were instrumented using Flexofiles in a precurved, anticurvature step-back filing method to an apical size 30. NT sensor files in a NiTiMatic system were used to an apical prep size of 40, then flared. Teeth were sectioned at ~1.0, 2.5 and 5.0 mm from the working length, ground, polished and stained. The mean percentage of canal wall planing was determined.

RESULTS: For the hand instrumentation group, the mean percentage apically was 77.2%, middle level was 81.2%, and coronal level was 76.9%. For the NiTi group, the same levels were 82.7, 79.9, and 62.8%. There was no significant differences between the 2 groups at any of the three levels. Overall, the difference between groups was also not significant.

C&C: The authors note that round canals were planed better, and that canals w/ fins were at best only planed 80%. 66% of the teeth had isthmi or excessively prolonged fins in at least one level. Communications frequently alternated from one level to the next. Canal transportation toward the furca was seen with both methods, but instrumentation to the CDJ occurred only in several sections of the hand filing group. Hand filing apparently had greater apical debris extrusion. The importance of irrigation and intracanal medicaments cannot be overemphasized.

March 1997 **Robin E. Hinrichs**

Goodell GG, Mork TO, Hutter JW, Nicoll BK. Linear dye penetration of a calcium phosphate cement apical barrier. J Endodon 1997;23:174-7.

PURPOSE: To compare linear dye penetration in teeth with open apices obturated with or without immediately placed apical barriers of calcium phosphate cement.

M&M: A #90 file was extended 1 mm beyond the apex of 42 single-rooted, single-canaled teeth. Forty of the roots were then randomly assigned to 2 groups. In group 1, 20 roots received 2 mm thick apical plugs of calcium phosphate cement (CPC) followed by obturation with custom-fitted, laterally condensed gutta-percha and sealer. In group 2, 20 roots were obturated in the same manner without apical plugs of CPC. The two remaining roots served as controls (positive and negative). Teeth were allowed to set for 48 hours at room temperature, then covered with nail polish, and immersed in India ink for 48 hours. The roots were then split longitudinally, and leakage was measured with 10x magnification.

RESULTS: The roots with apical CPC barriers demonstrated less dye penetration along the gutta-percha with a mean of 0.12 mm compared to a mean of 5.86 mm for roots without apical barriers. Roots with apical CPC barriers also showed less maximum extent of dye penetration with a mean of 2.88 mm compared to a mean of 7.16 mm for roots without apical barriers. The positive control demonstrated total dye penetration and the negative control showed no dye leakage.

C&C: Dye penetration typically stopped at the CPC-gutta percha interface.

March 1997 **Orest M. Harkacz, Sr.**

Dagher FB, Yared GM, Machtou P. An evaluation of 2% lidocaine with different concentrations of epinephrine for inferior alveolar nerve block. J Endodon 1997;23:178-80.

PURPOSE: To measure the degree of anesthesia obtained with 2% lidocaine with different concentrations of epinephrine: 1:50,000, 1:80,000, and 1:100,000.

M&M: 30 subjects received 1.8 ml of each solution 1 week apart, in a double blind study format. Anesthesia was checked initially, then every 3 min up to 50 min.

RESULTS: There were no significant differences between groups with respect to incidence of pulpal anesthesia, anesthetic failure, slow onset, non-continuous anesthesia, or short duration anesthesia.

C&C: Although not significant, it is interesting that the 1:80,000 concentration of lidocaine did better in nearly every category of each tooth tested. Perhaps it's pH is slightly different, or there is a good balance in the amount of stasis caused by the epinephrine, and its ability to still travel through the tissues.

March 1997 **Robin E. Hinrichs**

Ehrich DG, Lundgren JP, Dionne RA, Nicoll BK, Hutter JW. Comparison of triazolam, diazepam, and placebo as outpatient oral premedication for endodontic patients. J Endodon 1997;23:181-4.

PURPOSE: To compare oral premedication with 0.25 mg of triazolam, 5 mg of diazepam, or placebo administered in a double-blind fashion to patients undergoing endodontic treatment.

M&M: 79 endodontic patients with heightened anxiety were evaluated in the study. The patients received oral formulations of triazolam (0.25 mg), diazepam (5 mg), or placebo. The Digit Symbol Substitution Test (DSST) was used to measure cognitive function, and vertical and horizontal visual analogue scales (VVAS and HVAS) were used to measure anxiety. To evaluate memory impairment, the patient was shown the first of 7 simple drawings of common items, such as a chair or clock. The tests were administered before, during and after endodontic treatment. Patients were evaluated for a 24 hour postoperative recall.

RESULTS: In comparison with diazepam and placebo, triazolam was significantly better for decreased anxiety, impaired cognitive function, patients' rating of drug effectiveness, and amnesia to clinical events and pictures. Diazepam showed similar trends compared with placebo, but to a lesser degree. Diazepam also had a longer recovery period. No significantly adverse side effects were seen in any patient either during or after the procedure. At the follow-up telephone interview 24 hours later, six patients from the triazolam group reported symptoms of tiredness and 3 reported lightheadedness or dizziness the evening after the procedure.

C&C: Triazolam in this study was a more effective anxiolytic than diazepam for endodontic patients.

March 1997 **Orest M. Harkacz, Sr.**

Walvekar SV, Behbehani JM. Three root canals and dens formation in a maxillary lateral incisor: A case report. J Endodon 1997;23:185-6.

SUMMARY: A 19 yo presented for tx of a max right lateral. The tooth was discolored and non-responsive to pulpal testing. Apical tenderness to palpation was present, as was a large periapical radiolucency. The radiograph also revealed a dens invaginatus. Two main canals were treated, and what appears to be the dens connective tissue was also accessed.

C&C: This appears to be an Ohlers Class III dens invaginatus. The dens seems to bisect the main canal, forming the 2 canals that were instrumented well. The 3rd canal in the middle is in the dens and is lined w/ enamel, severely limiting its ability to be instrumented.

March 1997 **Robin E. Hinrichs**

Goswami M, Chandra S, Chandra S, Singh S. Mandibular premolar with two roots. J Endodon 1997;23:187.

SUMMARY: A case is presented of a mandibular second premolar with two roots branching in a mesiodistal direction. The condition was bilateral. This case is unique in that bifurcation of the roots among lower premolars usually occurs buccolingually.

March 1997 **Orest M. Harkacz, Sr.**